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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA-02535 (March 2003)
NASA
Superseding NASA-02535 (March 2002)

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SECTION 02535

PACKAGED LIFT STATIONS
03/03

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers furnishing and installing a package-type underground sewage-lift station of a capacity required by the project.

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PART 1 GENERAL

1.1 REFERENCES

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NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

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The publications listed below form a part of this section to the extent referenced:

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C207	(1994) Steel Pipe Flanges for Waterworks Service-Sizes 4 in. Through 144 in.

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASTM INTERNATIONAL (ASTM)

ASTM A 105/A 105M	(2001) Standard Specification for Carbon Steel Forgings for Piping Applications

ASTM A 123/A 123M	(2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 36/A 36M	(2001) Standard Specification for Carbon Structural Steel

HYDRAULIC INSTITUTE (HI)

HI SCRRP	(1994) Standards for Centrifugal, Rotary and Reciprocating Pumps

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1940-1	(1986e) Mechanical Vibration - Balance Quality Requirements of Rigid Rotors - Part 1: Determination of Permissible Residual Unbalance
ISO 2858	(1975) End Suction Centrifugal Pump (Rating 16 Bar) Designation Nominal Duty Point and Dimensions
ISO 5199	(1986) Technical Specifications for Centrifugal Pumps, Class II
ISO 7005-2	(1988) Metallic Flanges Part 2: Cast Iron Flanges

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-86	(1987; R 1992) Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electric Equipment (1000 Volts Maximum)

1.2 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01330 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal

description.
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The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixtures List shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-02 Shop Drawings

The following shall be submitted in accordance with paragraph entitled, "Design Requirements," of this section.

Fabrication Drawings
Erection/Installation Drawings

SD-03 Product Data

Manufacturer's catalog data and equipment and performance data shall be submitted for the following items:

Spare Parts Data shall also be submitted for the following in accordance with paragraph entitled, "General Requirements," of this section.

Man Hole Chambers
Entrance Covers
Sump Pumps
Sewage Pumps
Pump Controls
Impellers
Couplings
Bearings
Stuffing Boxes
Valves
Piping
Blowers
Dehumidifier
Electric Motors

SD-05 Design Data

Design Data of Motor/Pumps shall be submitted with Manufacturer part number following:

Rotor Bars
Stator Slots
Speed of Rotation
Cooling Fan Blades

Bearing Manufacturer
Bearing Style
Bearing Type
Balls/Elements
Commutator Bars
Commutator Brushes
SCR Firing Frequencies (for variable speed motors)
Pump Impellers

SD-07 Certificates

The following shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

Listing of Product Installations
Safety Considerations

Certificates shall be submitted for the following items in accordance with the applicable reference standards and description of this section.

Man Hole Chambers
Entrance Covers
Sump Pumps
Sewage Pumps
Bearings
Pump Controls
Impellers
Couplings
Stuffing Boxes
Valves
Piping
Blowers
Dehumidifier
Electric Motors

SD-08 Manufacturer's Instructions

Manufacturer's instructions including special provisions required to install equipment components and system packages shall be submitted for the following items.

Operating instructions, including standard operating procedures with startup, shutdown, and emergency operation shall be submitted for Package Lift Station, and the following:

Man Hole Chambers
Entrance Covers
Sump Pumps
Sewage Pumps
Pump Controls
Impellers
Couplings
Stuffing Boxes

Valves
Piping
Blowers
Dehumidifier
Electric Motors

The following shall be submitted in accordance with paragraph entitled, "General," of this section.

Preventative Maintenance and Inspection
Special Tools
Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted for package lift stations including the following in accordance with paragraph entitled, "Operation and Maintenance," of this section.

Equipment Description
Assembly and Installation Procedures
Adjustment and Alignment
Checkout Procedures
Procedures of Operation
Troubleshooting

1.3 DESIGN REQUIREMENTS

Actual range in capacities may vary from that stipulated if the minimum and maximum capacities specified are included.

Each station shall have two pumps with controls capable of operating the pumps either simultaneously or individually, depending on the load conditions.

Lift station shall be a complete unit with necessary appurtenances factory installed within a pump chamber and a vertical entrance tube cover and access ladder, all designed for the following:

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NOTE: Pump capacity, head, and service life shall be as required by the project.
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Service life - [15] [_____] years

Pump capacity - [125] [475] [_____] gallons liter per minute (gpm)

Total head - [115] [35] [_____] feet meter

Fabrication Drawings shall be submitted after receiving tentative approval of the equipment and the materials list but before installation, the Contractor shall submit drawings covering necessary or recommended changes to accommodate the equipment offered. Drawings shall clearly show the

design of the chamber, with dimensions, types, and thicknesses of materials, and elevation levels with reference to those elevations indicated.

Erection/Installation Drawings for the manhole chamber with the required equipment and accessories that are inclusive shall be submitted. Drawings shall clearly show the design of the chamber, with dimensions, types, and thicknesses of materials, and elevation levels with reference to those elevations indicated.

The following motor/pumps design data shall be provided prior to final turnover - number of motor rotor bars and stator slots; number of cooling fan blades; RPM of motor; bearings, bearing manufacturer, bearing type, bearing style and number of balls/elements; number of commutator bars and commutator brushes; SCR firing frequencies; and number of pump impellers.

1.4 PROTECTION FROM MOVING PARTS

Locate and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts in accordance with applicable OSHA standards and so that personnel are properly protected from injury.

1.5 NAMEPLATES

Each item of equipment shall have the manufacturer's name or trademark on a corrosion-resistant identification plate or cast integrally, stamped, or otherwise permanently marked in a conspicuous place. Pump identification plate shall show the pump capacity in gpm liter per minute, pump head in feet, meter, and speed of rotation. Direction of rotation shall be cast on the body of the pump. Other information considered necessary to complete identification such as the manufacturer, shall be shown on the identification plate.

1.6 FIELD REPRESENTATIVE

A representative of the lift station manufacturer shall direct the startup of the station and shall instruct representatives of the Government in startup and operation procedures.

1.7 GENERAL REQUIREMENTS

Material, Equipment, and Fixtures List of all major components shall be submitted. List shall include manufacturer's catalog numbers, specification and drawing reference number, warranty information, and fabrication site.

Listing of Product Installations similar to the package lift station the Contractor is installing shall be submitted.

Safety Considerations including information relating to load limits, speed of operation, environmental criteria (temperature and pressure limitations), and personnel hazards and equipment safety precautions for the package lift station shall be submitted.

Spare Parts Data shall be submitted, including a complete list of parts and supplies with current unit prices and source of supply. Also, list parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as a part of the contract, and list additional items recommended by the manufacturer to ensure an efficient operation for a period of 120 days.

PART 2 PRODUCTS

Materials and equipment for package lift station shall conform to the referenced publications or as specified and indicated and shall be the products of manufacturers regularly engaged in the manufacture of such products.

2.1 CHAMBER

[Chamber, including base, walls, and entrance tube shall be constructed of 5000 psi 35 Megapascal precast concrete designed to form an integral unit. [Wet well shall be constructed as an integral part of the unit with a separate manhole entrance.] Ladder, pipe supports, brackets, and other miscellaneous components shall be constructed of steel conforming to ASTM A 36/A 36M and hot-dipped galvanized in accordance with ASTM A 123/A 123M.]

Man hole chambers, including base, entrance tube, air ducts, and similar structural parts, shall be [steel conforming to ASTM A 36/A 36M] [reinforced fiberglass]. Steel shall be protected from corrosion by means of [hot-dip galvanizing conforming to ASTM A 123/A 123M] [epoxy-resin coatings]. [Cathodic protection shall be provided in accordance with Section 13110 CATHODIC PROTECTION.]

2.2 ENTRANCE COVERS

Entrance-tube cover shall be reinforced fiberglass or steel. If the cover is steel, it shall be securely bolted to the shaft flanges.

2.3 SUMP PUMPS

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NOTE: Capacity in gallons liter and the discharge head must be as required by the project.

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Pump shall be a submersible, direct-motor-driven unit with a capacity of 1,000 gallons 3800 liter per hour at a 40-foot 12.2 meter discharge head. Sump and pump shall be enclosed in 1/4-inch 7 millimeter mesh of corrosion-resistant metal.

Sump pumps shall conform to the applicable requirements of Section 15445 SUMP PUMPS.

2.4 SEWAGE PUMPS

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NOTE: Pump capacity must be as required by the

project.
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Pumps shall be of the nonclogging, centrifugal type designed to pump unscreened sewage. Each pump shall have a rated capacity as specified and be capable of passing 3-inch 75 millimeter solids. Pumps may be either horizontally mounted or vertical close coupled and shall conform to the requirements of HI SCRRP ISO 2858 and ISO 5199. [Pump speed shall not exceed 1,800 revolutions per minute.]

Sewage pumps shall conform to the applicable requirements of Section 15135 CENTRIFUGAL PUMPS.

2.5 PUMP CONTROLS

Pump controls shall conform to the applicable requirements of Section 16286 OVERCURRENT PROTECTIVE DEVICES.

Pump operating controls shall be as recommended by the pump station manufacturer, and shall be the automatic type including necessary switches, relays, and appurtenances, complete. Controls shall be mounted on a control panel. Equipment subject to contact with sewage shall be of corrosion-resistant metal. Alternators may be electrical or mechanical and shall automatically alternate the pump operation unless the liquid level continues to rise, in which case both pumps shall operate simultaneously. Controls shall be provided with a high-level switch for remote monitoring.

Each station shall have a three-wire receptacle for a portable generator in case there is an external power outage. Each station shall also have a double-throw switch in an enclosure conforming to NEMA 250, Type 3R. All wiring shall conform to the requirements of Section 16145 STANDARD WIRING SYSTEMS.

2.6 PUMP CONSTRUCTION

Castings shall be cast iron or steel free from injurious defects. Castings shall be designed to permit easy replacement of parts. Joints shall be gasketed and shall not leak under a test pressure equal to 50 percent more than the pump discharge pressure or total dynamic head, whichever is greater. Passageways shall permit the smooth flow of sewage and shall be free from sharp turns and projections. Pump castings shall be provided with cleanout plates in the suction line and drain plugs.

2.7 IMPELLERS

Impellers shall be of cast iron, cast steel, or an alloy suitable for the service required. Impellers shall be free flowing and shall permit objects in the sewage that enter the pump to pass into the discharge pipe. Each impeller shall be keyed, splined, or threaded on the shaft and locked in such manner that lateral movement will be prevented and reverse rotation will not cause loosening.

2.8 COUPLINGS

Couplings shall be the heavy-duty flexible type, keyed to the shaft. Couplings for vertical pumps may be the universal type.

2.9 SHAFT SLEEVES

Sleeves shall be of bronze or a suitable alloy designed to protect the shaft at points in contact with the stuffing boxes and other wearing parts. Sleeves shall also protect the shaft from the liquid being pumped.

2.10 STUFFING BOXES

Boxes shall be grease-sealed with a seal ring, designed to ensure tight packing without excessive wear or friction on the shafts, and prevent the leakage of air or water. Glands shall be the split type, easily removed for repacking.

2.11 BALANCE

Rotating parts of the equipment shall be mechanically and hydraulically in balance to operate throughout the required range without excessive end thrust, vibration, and noise. Allowable vibration limits shall be in accordance with ISO 1940-1, Table 1. Existence of defects that cannot be eliminated by adjustment will be sufficient cause for rejection of the equipment.

2.12 SHAFTS

Shafts shall be high-grade steel of a size and strength to perform the work required.

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NOTE: When possible, specify sealed bearings on motors. When properly installed sealed bearings have as long a life as conventional bearings, with almost no maintenance requirements.

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2.13 BEARINGS

Bearings shall be ball or roller type. Main bearings shall take radial and end thrust. Pumps that depend on hydraulic balance to overcome end thrust are not acceptable.

2.14 LUBRICATION

Bearings on vertical-shaft pumps shall be [the grease type provided with fittings for a grease gun and, if not easily accessible, with grease tubing extending to convenient locations. Grease fittings shall be the pump manufacturer's standard type .] [self lubricating, permanently sealed]

2.15 PIPING CONNECTIONS

Pump suction and discharge shall be provided with flanged connections of the proper size for the pump type and capacity. Pipe flanges shall conform to ASTM A 105/A 105M, ASME B16.1 or AWWA C207 MSS SP-86, ISO 7005-2.

2.16 SUMP PUMP CONTROL

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NOTE: Insert head differential size.
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Sump pump shall be automatically actuated by a built-in float responsive to a [_____] inch pascal head differential.

2.17 VALVES

Gate valves shall conform to MSS SP-70. Check valves shall be of horizontal, swing check type. Valves shall permit a free flow of sewage forward and provide a positive check against backflow. Body shall be iron and have a removable cover for inspection and removal of the gate assembly. Gate, gate seats, shaft, studs, and nuts shall be bronze.

2.18 PIPING

Discharge lines shall terminate 5-feet 1.5 meter outside the lift station in flanged connections. Suction line shall include the pipe from the wet well manhole.

2.19 VENTILATING BLOWER

Blowers shall be capable of one air change every [3] [_____] minutes. A manual and automatic switch shall be mounted on the side of the entrance tube for operation of the blower. Vent to atmosphere shall have covers and screens to prevent the entrance of rain, insects, and rodents. Blower shall be automatically actuated upon opening the entrance tube cover, unless overridden by the manual control.

Blower motor shall conform to the applicable requirements of Section 16225 MOTORS.

Blower controls shall conform to the applicable requirements of Section 16286 OVERCURRENT PROTECTIVE DEVICES.

2.20 DEHUMIDIFIER

A packaged dehumidifier shall be furnished and installed in accordance with lift station manufacturer's recommendations. Controls shall include a humidistat and low-temperature cutout. Condensate shall be discharged to the wet well.

Dehumidifier controls shall conform to the applicable requirements of Section 16286 OVERCURRENT PROTECTIVE DEVICES.

2.21 EMERGENCY OVERFLOW

A gravity-overflow line shall be provided from the wet well. Overflow line shall terminate with a headwell and flap valve.

2.22 ELECTRIC MOTORS

Motors shall conform to the requirements of Section 16225 MOTORS and shall be 60-hertz, 3-phase.

2.23 PAINT

Equipment shall be treated and painted in accordance with the manufacturer's standard practice for sewage resistance.

PART 3 EXECUTION

3.1 GENERAL

Lift station shall be installed as indicated, in accordance with drawings and the manufacturer's instructions.

Preventative Maintenance and Inspection procedure for package lift stations shall be submitted. Procedures should include frequency of preventative maintenance, inspection, adjustment, lubrication, and cleaning necessary to minimize corrective maintenance and repair.

Special Tools that are required for maintenance and testing of the package lift stations shall be submitted.

Posted Instructions consisting of labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the package lift stations shall be submitted.

3.2 TESTS

Tests, including hydrostatic leak checking of piping and operation of equipment, shall be performed as directed.

3.3 OPERATION AND MAINTENANCE

Operation and Maintenance Manuals for package lift stations shall be submitted, including Equipment Description, Assembly and Installation Procedures, Adjustment and Alignment, Checkout Procedures, Procedures of Operation and Troubleshooting.

-- End of Section --